IS 8925 (1978): Alternators for Automobiles [TED 11: Automotive Electrical Equipment]

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Indian Standard

SPECIFICATION FOR ALTERNATORS FOR AUTOMOBILES

(First Reprint OCTOBER 1997)

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Gr 5 *January* 1979

AMENDMENT NO. 1 MARCH 1984

TO

IS:8925-1978 SPECIFICATION FOR ALTERNATORS FOR AUTOMOBILES

Alteration

(*Page 16, clause D-4.1, second line*) - Substitute 'maximum speed + 10 percent' *for* '110 percent of maximum application speed'.

(ETDC 14)

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AMENDMENT NO. 2 AUGUST 1991
TO
IS 8925 : 1978 SPECIFICATION FOR ALTERNATORS FOR AUTOMOBILES

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(*Page* 7, *clause* **5.3.1**, *line* 1) — Substitute 'M5' *for* 'M6 × 1.25'.

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Indian Standard

SPECIFICATION FOR ALTERNATORS FOR AUTOMOBILES

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Indian Standard

SPECIFICATION FOR ALTERNATORS FOR AUTOMOBILES

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 30 August 1978, after the draft finalized by the Automobile Electrical Equipment Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 This standard is related to alternators or ac generators with diode rectification intended for charging systems of automobiles. This standard lays down the methods of specifying the performance, presentation of data and testing of alternators with a view to bring about an acceptable level of quality and reliability.

0.3 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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1. SCOPE

1.1 This standard covers basic requirements for specifying, evaluating and methods of testing 12 V and 24 V alternators intended for automobiles charging systems.

1.2 This standard does not cover alternators intended for motor cycles.

2. TERMINOLOGY

2.0 For the purpose of this standard, following definitions shall apply.

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*Rules for rounding off numerical values (*revised*).

2.1 Alternator — The device which converts mechanical power into direct current electrical power by means of a rotary field structure for excitation, a generating winding and a network of diodes for rectification, all of which are contained in an integral package.

NOTE — In certain applications, the rectification circuit may be mounted externally.

2.2 Alternator with Inbuilt Regulator — The alternator where the regulator is an integral part of the alternator assembly.

2.3 Nominal System Voltage — The battery or system voltage which is 12 or 24 V.

2.4 Rated Voltage — The voltage at which the alternator is designed to operate in the system. (This may be different from the test voltage at which nominal output is specified.)

2.5 Test Voltage — For purpose of testing, the following voltage shall be maintained across the main terminals of the alternator unless otherwise specified:

Nominal System Voltage	*Test Voltage*
12 V	13·5 ± 0·1 V
24 V	27·0 ± 0·2 V

2.6 Nominal Output — The output current (less the current required for field excitation) which a cold alternator can deliver to the system at the test voltage when driven at speed specified by the manufacturer, while the alternator is at an ambient temperature of not exceeding 40°C.

2.7 Rated Output — The minimum output current (less the current required for field excitation) which a hot alternator can deliver to the system at the test voltage when driven at speed specified by manufacturer after stabilization of alternator temperature.

2.8 Cut-In Speed — The minimum speed at which the alternators shall just commence charging and which is measured as the maximum speed at which the alternator just ceases to charge a sound battery maintained at 12 ± 0·1 V and 24 ± 0·2 V.

2.9 Maximum Application Speed — The speed which should not be exceeded in the application.

2.10 Type Tests — Tests which are intended to prove general quality and design of an alternator for a given application.

2.11 Acceptance Tests — Tests carried out on samples taken from a lot for the purpose of acceptance of the lot.

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2.12 Routine Tests — Tests carried out on each alternator to check essential requirements which are likely to vary during production.

3. TYPES OF ALTERNATORS

3.0 The alternators are classified based on their capabilities of withstanding various environmental and operating requirements.

3.1 Enclosures

3.1.1 *Normal Ventilated* — Alternator with adequate openings on end covers for through flow of air created by an externally or internally mounted fan.

3.1.2 *Splash Protected* — Alternator with adequate covers and protective coatings to enable the alternator to operate satisfactorily under water splash created by road and weather conditions.

NOTE — Any other special enclosures may be accepted as agreed upon between the manufacturer and the purchaser.

3.2 Operating Duty — The operating duty of an alternator shall be based on the belt tension [*see* **D-2.1**(f) and **D-3.1**(f)].

3.2.1 *Light Duty* — Alternator suitable for passenger car and light commercial and tractor applications.

3.2.2 *Medium Duty* — Alternator suitable for public transport (bus) and similar type commercial vehicles.

3.2.3 *Heavy Duty* — Alternator suitable for off highway equipment with severe operating conditions (for example earthmovers with large radiator fans, auxiliary drives, etc).

4. CONSTRUCTION

4.0 The principal components of the alternator may be as follows:

a) Stator,
b) Rotor,
c) Slip ring end bracket,
d) Drive end shield bracket,
e) Rectifier assembly, and
f) Regulator (for alternator with in-built regulator).

4.1 Stator — It consists of a laminated core which houses the insulated generating windings connected to a network of diodes for rectification.

4.2 Rotor — It consists of a suitable field structure for excitation mounted on a shaft.

4.3 Slip Ring End Shield — It houses the rectifier assembly, terminal arrangement for main output and field system and a bearing in which the rotor shaft rotates. It also supports the stator.

4.4 Drive End Shield — It supports the stator and houses a bearing in which the rotor shaft rotates.

4.5 Rectifier Assembly — This consists of a silicon diode pack for converting the ac output of the stator to dc for the charging system.

In addition, it might carry a set of auxiliary diodes for feeding the excitation windings independent of the battery current.

4.6 Regulator — It is an electromechanical or electronic device to control the main output terminal voltage within certain limits specified by the manufacturer for satisfactory charging.

NOTE — The regulator may also limit the output currents to safe values, particularly in case of totally enclosed alternators. Provision for battery charge indication (for example warning lamp) may also be included.

5. MARKING

5.1 Each alternator shall be marked or affixed with a name plate with the following information:

a) Name and/or trade-mark of manufacturer,

b) Type number,

c) Nominal voltage,

d) Direction of rotation, and

e) Country of manufacture (optional).

NOTE — In case of alternator with inbuilt regulator, the type number may be suffixed by letter ' R '

5.1.1 Each alternator may also be marked with the Standard Mark.

5.1.2 The use of the Standard Mark is governed by the provisions of the Bureau of Indian Standards Act, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

5.2 Terminals

5.2.1 The main terminals shall be identified as below:

a) Main output terminals — ' + ' and '—';
b) Field terminal for regulator connection — 'F';
c) Auxiliary output terminal — 'A', if provided; and
d) Warning lamp 'WL'.

5.3 Terminations — The terminations shall be made so as to avoid interchange in the field.

5.3.1 The minimum size of the negative terminal shall be M6 × 1·25 and the positive terminal shall be bigger. 'WL', 'A' and 'F' terminals shall be 6·3 mm male blade connectors if the terminals are to be connected externally to the system.

6. TESTS

6.0 Classification of Tests

6.0.1 *Type Tests* — The following shall constitute type tests:

a) Visual examination (*see* **6.1**),
b) Dimensional check (*see* **6.2**),
c) Flash test (*see* **6.3**),
d) Output characteristic (cold) check (*see* **6.4**),
e) High speed check (*see* **6.5**),
f) Temperature-rise test (*see* **6.6**),
g) Performance test (output characteristic — hot) (*see* **6.7**),
h) Endurance test (*see* **6.8**),
j) Vibration test (*see* **6.9**),
k) Salt spray test (*see* **6.10**),
m) Damp Heat (cycling) test (*see* **6.11**),
n) Dust test (*see* **6.12**),
p) Water spray test (*see* **6.13**),
q) Water immersion test (*see* **6.14**), and
r) Special tests (*see* **6.15**).

NOTE — All or any of the tests classified under special tests shall be conducted only on the basis of specific agreement between the supplier and the purchaser.

6.0.2 *Criteria for Approval* — Nine samples shall be submitted for testing with relevant data. These shall be tested according to the test schedule given in Appendix A. In case of totally enclosed type alternators, the number of samples to be submitted shall be 10.

6.0.3 In case of failure in one or more type tests, the testing authority may call for fresh samples not exceeding twice the number of original samples and subject them to the test(s) in which failure occurred. If, in repeat tests no failure occurs, the tests may be considered to have been satisfied.

6.0.4 *Acceptance Tests* — The following shall constitute acceptance tests:

a) Visual examination (*see* **6.1**),
b) Dimensional check (*see* **6.2**),
c) Output characteristic (cold) check (*see* **6.4**),
d) High speed check (*see* **6.5**),
e) Temperature-rise test (*see* **6.6**), and
f) Performance test (output characteristic — hot) (*see* **6.7**).

NOTE 1 — Number of samples for acceptance tests shall be as agreed upon between the purchaser and the manufacturer. However, the recommended plan of sampling is given in Appendix B.

NOTE 2 — For each batch of supply, one or more samples as agreed upon between the manufacturer and the purchaser shall be tested according to **6.6** and **6.7**.

6.0.5 *Routine Tests* — The following shall constitute routine tests:

a) Visual examination (*see* **6.1**),
b) Output characteristic (cold) check (*see* **6.4**), and
c) High speed check (*see* **6.5**).

6.1 Visual Examination — The alternator assembly shall be examined visually for correct assembly and finish and shall be free from injurious flaws or damages.

6.2 Dimensional Check — The alternator assembly shall be checked for dimensions using conventional measuring instruments. The alternator shall conform to the outline drawing submitted by the manufacturer.

6.3 Flash Test (for Rotor and Stator Sub-assemblies Only) — This test shall be carried out only on sub-assemblies of alternator. The rotor/stator winding shall be subjected to flash test between winding ends and frame/body with an alternating voltage of 250 V having a frequency 40 to 60 Hz for 5 seconds. As a result of this test, there shall be no looseness, cracking, charring, arcing or puncture of any portion of winding.

NOTE — Flash test shall not be done on complete assemblies. This may damage semiconductor components.

6.4 Output Characteristic (Cold) Check

6.4.0 The following tests are intended as quick check on cold output characteristics. The test circuit and test condition are given in Appendix C.

6.4.1 *Nominal Output* — The alternator shall be driven at a constant speed and in the direction specified by the manufacturer. The resistive load shall be quickly adjusted to maintain test voltage across the main output terminals. The output current recorded shall not be lower than the value specified by the manufacturer. The test shall be completed within 60 seconds.

6.4.2 *Cut-In Speed* — After the output check, the load is disconnected and the alternator speed is gradually reduced till the ammeter reads zero. The maximum speed at which the ammeter reads zero shall not be greater than the value specified by the manufacturer. The battery shall be maintained between 12·5 and 13 V for 12 V alternators and, 25 and 26 V for 24 V alternators by connecting external load if necessary.

6.5 High Speed Check — The alternator shall be connected as given in Appendix C and shall be driven in the direction indicated. The speed is gradually increased to the maximum speed specified by the manufacturer and the alternator shall be run at the maximum speed for 30 seconds. There shall be no abnormal noise or vibration injurious to the alternator arising out of rubbing between stator and rotor or rough bearings. During this test, the main terminal load shall be maintained at 80 percent of the nominal output.

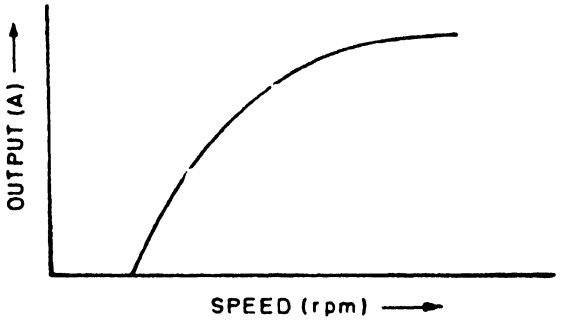
6.6 Temperature-Rise Test — The alternator shall be connected as given in Appendix C and shall be driven at a constant speed specified by the manufacturer (5 000 rev/min is recommended for most of the applications, unless it is specified otherwise). The load resistor shall be continuously adjusted to maintain a test voltage across the main output terminals. The test shall be continued till the alternator temperature is stabilised. The temperature rise of stator and diode assembly as measured with contact thermometers shall not exceed the limits specified by the manufacturer.

Recommended maximum values when temperature-rise limit is not specified:

Stator	65°C
Diode	95°C

6.7 Performance Test (Output Characteristics — Hot) — The alternator shall be connected and driven as specified in **6.6**. At the end of the temperature rise test, the output of the alternator (indicated by ammeter) is recorded. This test is repeated at 5 different speeds

allowing the alternator to stabilise at each speed (by running for 15 minutes at each speed). The output *vs* speed curve so obtained shall not be lower than the curve specified by the manufacturer. The typical performance curve is shown in Fig. 1. The curve shall be extended to intersect with *X*-axis (speed).



Terminal voltage:

13·5 V for 12 V

27·0 V for 24 V

Ambient temperature: 30° to 40°C

Recommended speed: 2 000, 3 000, 4 000, 5 000 and 6 000 rpm.

FIG. 1 TYPICAL PERFORMANCE CHARACTERISTIC OF ALTERNATOR

6.8 Endurance Test — The alternator shall be subjected to endurance test as specified in Appendix D.

6.9 Vibration Test

6.9.1 The alternator shall be mounted on a vibrator capable of giving the following cycle and in a manner simulating engine mounting conditions. The test shall be carried out in three mutually perpendicular planes for period of one hour each according to the cycle given below:

Frequency	50 to 150 Hz (logrithmic sweep)
Acceleration	5 g constant
Cycle time	4 to 5 minutes (for one sweep)

6.9.2 *Assessment After the Test* — The alternator shall function satisfactorily and shall meet the test requirements of output characteristic check (**6.4**) and high speed check (**6.5**).

6.10 Salt Spray Test — This test shall be carried out as given in Appendix A of IS : 1884-1970*.

6.10.1 At the end of the test, the alternator shall function satisfactorily and shall meet test requirements of **6.4** and **6.5**. External appearance shall not be a cause for rejection.

6.11 Damp Heat (Cycling) Test

6.11.1 The test shall be conducted in accordance with IS : 2106 (Part II)-1962†. The number of conditioning cycles shall be 7.

6.11.2 At the end of the test the alternator shall function satisfactorily and shall meet test requirements of **6.4** and **6.5**. External appearance shall not be a cause for rejection.

6.12 Dust Test

6.12.1 The test shall be carried out in accordance with IS : 2106 (Part XII)-1965‡.

6.12.2 After the test the alternator shall function satisfactorily and shall meet the test requirements of **6.4** and **6.5**.

6.13 Water Spray Test — This test is applicable only for splash proof (*see* **3.1.2**) and totally enclosed (*see* **3.1.3**) type alternators.

6.13.1 The test shall be conducted in accordance with IS : 2106 (Part XI)-1965§.

6.13.2 After test, the alternator shall function satisfactorily and shall meet the test requirements of **6.4** and **6.5**.

6.14 Water Immersion Test — This test is applicable only to totally enclosed type alternator (*see* **3.1.3**).

6.14.1 The test shall be conducted in accordance with IS : 2106 (Part X)-1965‖ for a period of 60 minutes. The height of water shall be 15 cm above the centre line of the shaft of the alternator.

6.14.2 Water shall not have entered inside the alternator. The alternator shall function satisfactorily and shall meet the test requirements of **6.4** and **6.5**.

6.15 Special Test — The alternator shall be subjected to special tests as specified in Appendix E.

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*Specification for automobile electric horns (*first revision*).
†Environmental tests for electronic equipment: Part II Damp heat (cycling) test.
‡Environmental tests for electronic equipment: Part XII Dust test.
§Environmental tests for electronic equipment: Part XI Water spray test.
‖Environmental tests for electronic equipment: Part X Water immersion test.

APPENDIX A

(*Clause* 6.0.2)

TEST SEQUENCE FOR TYPE APPROVAL

Clause No.	*Test*	*Sequence*									
		1	2	3	4	5	6	7	8	9	10
6.1	Visual Examination	×	×	×	×	×	×	×	×	×	×
6.2	Dimensional Check	×									
6.3	Flash Test		×								
6.4	Output Check			×	×	×	×	×	×	×	×
6.5	High Speed Check			×	×	×	×	×	×	×	×
6.6	Temperature Rise Test			×							
6.7	Performance Test			×							
6.8 & D-2	Normal Speed Endurance Test				×						
6.8 & D-3	High Speed Endurance Test					×					
6.8 & D-4	Overspeed Endurance Test					×					
6.9	Vibration Test						×				
6.10	Salt Spray Test							×			
6.11	Damp Heat (Cycling) Test								×		
6.12	Dust Test									×	
6.13*	Water Spray Test	×									
6.14*	Water Immersion Test										×

×Sample to be tested.
*Optional tests based on type of enclosure.

APPENDIX B

(*Clause* 6.0.4)

RECOMMENDED PLAN OF SAMPLING

B-0. GENERAL

B-0.1 If statistical quality control techniques have been used for production control such test results and relevant charts may be made available along with the material supplied to enable the purchaser to judge the acceptability or otherwise of a lot. In case such information is not available, the following procedure is recommended for judging conformity of a lot with the requirements of this specification.

B-1. SCALE OF SAMPLING

B-1.1 Lot — In any consignment, all the alternators of the same size and from the same batch of manufacture shall be grouped together to constitute a lot.

B-1.2 The number of alternators to be selected from a lot shall depend upon the lot size and shall be in accordance with col 1 and 2 of Table 1.

TABLE 1 SIZE OF SAMPLE AND CRITERION FOR CONFORMITY

Lot Size N	Sample Size n	Permissible Number of Defectives
(1)	(2)	(3)
51 to 150	5	0
151 ,, 300	13	1
301 ,, 500	20	1
501 ,, 1 000	32	2
1 001 and above	50	3

Note — For the lot size up to 50, the sample size and the permissible number of defectives shall be as agreed upon between the manufacturer and the purchaser.

B-1.3 These alternators shall be selected at random. In order to ensure randomness, the following procedure may be adopted:

Arrange the alternators in a systematic manner and starting from any alternator count them as 1, 2,....., etc, up to r, r being equal to the integral part of N/n, N being the lot size and n the sample size. Every rth alternator shall be included in the sample.

B-2. NUMBER OF TESTS

B-2.1 All the alternators selected under **B-1.2** shall be subjected to acceptance tests given in **6.0.4.**

B-3. CRITERION FOR CONFORMITY

B-3.1 A lot shall be considered as conforming to this specification if, the number of alternators out of those tested, failing to satisfy the requirements of any one or more of acceptance tests, does not exceed the corresponding number given in col 3 of Table 1.

APPENDIX C

(*Clauses* 6.4 to 6.6)

TEST CONDITIONS AND TEST CIRCUIT FOR ALTERNATOR

C-1. APPARATUS

C-1.1 Drive — Capable of driving the alternator in the specified direction from 600 rev/min to 110 percent of maximum application speed.

C-1.2 Meters — Meters of 1 percent accuracy shall be provided for measurement of speed, voltage and current.

C-1.3 Load — Resistive load capable of being raised from zero to maximum load and continuously rated for maximum load.

C-1.4 Battery — Fully charged battery as applicable.

C-2. TEST CONDITIONS

C-2.1 Enclosures — The alternators shall be fitted with fan and all applicable enclosures.

Obstruction to air flow through the machine should be avoided and any obstruction must not be closer than 50 mm to the inlet and outlet passages.

C-2.2 Cable Resistances — The cable resistance shall be chosen to limit the drop between alternator and battery to a maximum of 0·5 volt when carrying the full output current.

C-2.3 Ambient Temperature — The ambient temperature shall not exceed 40°C.

C-3. CIRCUIT DIAGRAM

C-3.1 The alternator shall be connected along with the regulator recommended by the manufacturer. The ammeter shall be so connected to record the output current flowing into the battery and load only and hence will not include the current drawn by the field winding and the regulator. The actual details of circuit connections shall be as agreed between the purchaser and the manufacturer, as the details can vary considerably depending on the type of alternator and regulator. A typical circuit diagram is shown in Fig. 2.

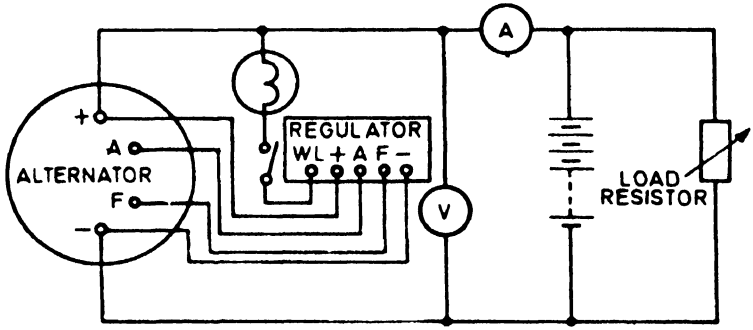

FIG. 2 TYPICAL CIRCUIT DIAGRAM FOR ALTERNATOR

APPENDIX D

(*Clause* 6.8)

ENDURANCE TESTS (OPERATIONAL LIFE TESTS)

D-1. GENERAL

D-1.1 All the following tests shall be carried out with correct fan and all applicable enclosures. The alternator shall be fitted with recommended pulley and driven by means of a belt to simulate vehicle mounting conditions with adequate provision for adjusting the belt tensions. The belt tensions must be checked and adjusted if necessary after a 50-hour initial run. Subsequently the belt tensions must be checked and adjusted if necessary once in two weeks. The connections shall be as specified in Appendix C.

D-2. NORMAL SPEED ENDURANCE TEST

D-2.1 The alternator shall be tested under following conditions:

a) Ambient Temperature	40°C *maximum*
b) Alternator output	60 percent of rated output
c) Terminal voltage	Manufacturer's recommended regulator setting
d) Speed	50 percent of maximum speed
e) Duration of test	1 000 hours
f) Belt tension static (stabilised after 50 hours)	15 ± 2 kgf — light duty 25 ± 2 kgf — medium duty 35 ± 2 kgf — heavy duty

NOTE — The values of belt tension are based on a wrap angle of 170 ± 10° with alternator driven directly by motor (two pulley arrangement).

D-3. HIGH SPEED ENDURANCE TEST

D-3.1 The alternator shall be tested under following conditions:

a) Ambient temperature	40°C *maximum*
b) Alternator output	Maximum rated output
c) Terminal voltage	13·5/27·0 volts
d) Speed	Maximum speed
e) Duration of test	100 hours
f) Belt tension static (stabilised after 50 hours)	15 ± 2 kgf — light duty 25 ± 2 kgf — medium duty 35 ± 2 kgf — heavy duty

NOTE — The values of belt tension are based on a warp angle of 170 ± 10° with alternator driven directly by motor (two pully arrangement).

D-4. OVERSPEED ENDURANCE TEST

D-4.1 On completion of high speed endurance test (*see* **D-3**), the alternator shall be driven for a further period of 1 hour at 110 percent of maximum application speed under the same load condition.

D-5. ASSESSMENT AFTER ENDURANCE TESTS

D-5.1 On completion of the endurance tests, the alternator shall be cooled to room temperature and checked for output according to **6.4**. The normal output shall not have been reduced by more than 10 percent and cut-in speed shall not have increased by more than 10 percent.

NOTE — For externally mounted regulators used in conjunction with alternators, the regulator may be replaced by a new one at the end of its specified life.

APPENDIX E

AMENDMENT NO. 1 MARCH 1984

TO

IS:8925-1978 SPECIFICATION FOR ALTERNATORS FOR AUTOMOBILES

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D-5.2 The field brushes should not have worn out to the extent of exposing the pigtails.

APPENDIX E

(*Clause* 6.15)

SPECIAL TESTS

E-1. BATTERY REVERSAL TEST

E-1.1 The alternator and regulator system is connected as specified in manufacturer's recommendation in respect of cable details such as cable size, resistance and terminals. Any recommended accessories such as fuse, cut-out, etc, shall be incorporated in the system.

E-1.2 A fully charged battery of recommended capacity (as used in the actual installation) shall be connected to the system through a reversing switch. The battery polarity shall be reversed quickly and maintained in that position for a period of 5 seconds or till such time the fuse blows whichever is earlier and then quickly restored to normal polarity. During this test, the alternator is held stationary. At the end of the test, there shall be no permanent damage to the system and the alternator shall pass the tests specified in **6.3** and **6.4** after replacing any recommended replaceable parts such as fuse links, etc.

E-2. LEAD DISCONNECTION TEST

E-2.1 The alternator shall be connected as specified in Appendix C. The alternator shall be tested according to **6.3** with each of the alternator/regulator external terminals disconnected one at a time. There shall be no failure to any component and the alternator must function satisfactorily each time when the leads are reconnected and shall pass the test as given in **6.4**.

NOTE — Failure to develop output with any lead disconnected is not a cause for rejection. But there shall be no uncontrolled output resulting in excessive terminal voltages with any lead disconnected.

BUREAU OF INDIAN STANDARDS

Headquarters:
Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002
Telephones: 323 0131, 323 3375, 323 9402
Fax : 91 11 3234062, 91 11 3239399, 91 11 3239382

Telegrams : Manaksanstha
(Common to all Offices)

	Telephone
Central Laboratory:	
Plot No. 20/9, Site IV, Sahibabad Industrial Area, Sahibabad 201010	8-77 00 32
Regional Offices:	
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*Eastern : 1/14 CIT Scheme VII M, V.I.P. Road, Maniktola, CALCUTTA 700054	337 86 62
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Institution of Engineers (India) Building 1332 Shivaji Nagar, PUNE 411005	32 36 35
T.C. No. 14/1421, University P. O. Palayam, THIRUVANANTHAPURAM 695034	6 21 17

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*Sales Office is at 5 Chowringhee Approach, P.O. Princep Street, CALCUTTA 700072	27 10 85
†Sales Office is at Novelty Chambers, Grant Road, MUMBAI 400007	309 65 28
‡Sales Office is at 'F' Block, Unity Building, Narashimaraja Square, BANGALORE 560002	222 39 71

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